

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

382B - FENCE - HIGH TENSILE ELECTRIC WIRE

1. SCOPE

This work shall consist of furnishing and installing permanent electrified fences and related essential components. Unless otherwise specified, complete electric high tensile fence systems constructed in strict accordance to a single manufacturer's recommendations will be accepted as an equivalent substitute to these specifications.

2. MATERIALS

Unless otherwise shown on the drawings or specified in Section 13, materials for high tensile fencing shall conform to the following requirements:

Wire

Wire used for direct livestock control shall be new, smooth, conductive to the outer surface, Class III galvanized wire, minimum 14 gauge with a minimum breaking strength of 1000 pounds.

Wire used as leadout from the energizer to the charged strands of fence and grounding system, or used to pass electric pulses underneath gate openings or above watercourses shall be insulated 12-1/2 gauge wire rated a minimum of 20,000 volts.

Insulators

The insulators shall be new high density porcelain, ultra-violet light resistant high density molded plastic, or flexible tube type insulators labeled for high-tensile applications.

Staples

The staples shall be Class III galvanized minimum 9 gauge wire slash cut point staples. When used on softwood posts, staples must have barbs and have a minimum length of 1.6 inches

Energizers

The energizers shall be manufactured fence energizers, which are safety approved by U.S. Bureau of Standards, Underwriters Laboratories (UL), or other international standards with approvals printed on the energizer name plate.

Fence energizers may be powered by commercial/public electric utility (115/230VAC), battery, or solar. Where solar panels are relied upon, the actual output of the panel must be sufficient to adequately recharge battery(s) and power energizer for the average solar radiation received at the site of use.

Energizers shall be capable of producing the minimum electrical output required under normally expected conditions consistent with the kind and class of livestock, the type and amount of fencing, and any other considerations significantly affecting livestock control.

Posts

All brace, corner, and gate posts shall be blunt end black locust, red or white cedar, minimum 0.40 lbs./ft³ CCA pressure treated softwood, or other material of equivalent longevity and strength. In mineral soils, post top diameter shall be a minimum of 5 inches, the length of the post shall be a minimum of 7-1/2 feet. In organic soils, depth shall be as specified in Section 13. Wood posts shall be structurally sound, predominantly straight throughout their length, with all limbs trimmed flush with the body of the post.

Line posts shall be black locust, red or white cedar, 0.40 lbs./ft³ CCA pressure treated softwood, steel "T" or "U" posts, fiberglass "T" or round posts, or other material of equivalent longevity and strength. In mineral soils line wooden posts top diameter shall be a minimum of 3-1/2 inches with a minimum length of 5-1/2 feet. In organic soils, depth shall be as specified in Section 13. All steel or fiberglass line posts shall have a minimum length of 5-1/2 feet, fiberglass "T" posts shall have a minimum width of 1.2 inches, and fiberglass round posts a minimum of 3/4 inch diameter.

Brace rails shall be a minimum 4 inches in diameter for wooden or a minimum of 1-1/2 inches diameter for galvanized steel pipe. Square rails with the equivalent cross section may be used. Length of brace rails shall be a minimum of 8 feet long where horizontal and 10 feet long where diagonal.

Battens

Battens shall be 3 to 6 feet in length. They shall be pressure treated hardwood or naturally decay resistant hardwood or plastic 1 to 1-1/2 inches in width and 1 inch in thickness, fiberglass notch "T" posts of 5/8 inch minimum width or round fiberglass posts of 1/2 inch minimum diameter.

Gates

All gates along boundary fences shall be either a physical barrier (e.g., tubular steel) or a psychological barrier of electric conductors, at least two of which must be of solid metal. Electrified gates shall become charged upon closing. The containment/exclusion ability of the gate shall be commensurate with the kind and class of livestock held, potential of predator penetration, and degree of risk if breached.

3. SETTING POSTS AND BATTENS

Spacing

Posts and battens shall be spaced according to Table 1 below, unless otherwise shown on the drawings or specified in Section 13. Topographic features of the site may dictate even closer spacing.

Table 1. Maximum Spacing of Fence Posts for High-Tensile Electric Fence.

Number of Wires	Maximum Line Post Spacing (feet)		Maximum Batten Spacing (feet)
	with Battens	without Battens	
1	-	75	-
2	150	75	75
5	150	50	50
7	66	33	33

Method of Installation

The minimum depth of corner, gate, and end assembly posts, if not shown on drawings or specified in Section 13, shall be 3-1/2 feet deep. Line posts shall be 1-1/2 feet deep.

When posts are driven, the top of the post shall be protected from splitting by applying driving pressure uniformly over the entire post end area. Posts that are damaged during driving shall be removed from the fence and replaced.

Where posts are set in hand-dug or augured holes:

- Postholes shall be at least 6 inches larger than the diameter or side dimensions of the posts.
- Posts shall be positioned on the face of the hole from where the resultant pull is originating.
- Earth backfill around the posts shall be thoroughly tamped in layers not thicker than 4 inches and shall completely fill the posthole to the ground surface. Concrete backfill around the posts shall be rodded into place in layers not

thicker than 12 inches and shall completely fill the posthole to the ground surface. Backfill, either earth or concrete, shall be crowned up around the posts to 2 inches above the ground surface.

- d. No stress shall be applied to posts set in concrete until at least 24 hours after the concrete has set. Posts for gates shall be allowed to set for at least 48 hours.

4. CORNER ASSEMBLIES

Wherever the fence line changes horizontal direction greater than 20 degrees but less than 45 degrees, a single corner post shall be installed. When encountering horizontal deflections in the fence equal to or greater than 45 degrees, use a brace assembly as specified in Section 5.

5. BRACE ASSEMBLIES

A double brace assembly shall be used at corners, gate openings, fence ends, and at both sides of a stream crossing when greater than 6 strands of wire are used. A single brace assembly - 'H' brace or diagonal floating brace - may be used with 6 or fewer strands of wire. On mineral soils, single corner posts may be employed for 2 or less strands of wire provided posts are set by power post driver and installed with a 3-4 inch lean away from the resultant pull of wires. For organic soils, use an 'H' brace or double brace assembly as a minimum.

Pull post assemblies (i.e., end assemblies) shall be installed at intervals of every 4000 feet or less on continuous straight reaches, and at points where the fence deflects upward greater than 10 degrees.

6. ATTACHING WIRE TO POSTS

The wire shall be attached and tensioned to posts as follows:

- a. In general, the wire shall be placed on the side of the post opposite the area being protected. In the case of curves and corners, wire shall be placed on the outside of posts unless swing corners are used.
- b. The wire shall be fastened to each corner, end, gate, and line post with staples or other appropriate fasteners. Insulators shall be used for all wires at every contact point with posts, brace rails, and tensioning wires, except where posts and rails are non-conductive.
- c. Wires shall be terminated or spliced by employing manufactured devices labeled for those specific high-tensile applications.
- d. Staples shall be driven diagonally to the grain of the wood and shall be driven so as not to restrict movement of wire past that contact point. Staples shall be driven into posts at an upward angle in depressions and at a downward angle on knolls

- e. Each wire shall have one permanent in-line wire strainer to maintain correct tension; every 4,000 feet for straight line fence stretches, every 2,500 feet for fences with one 90° corner, and every 1,200 feet in uneven terrain with several dips and rises or non-linear reaches. Tension indicator springs are optional, but may be most beneficial in reaches under 600 feet. In-line strainers shall be placed near the friction center of the fence line.
- f. Where there is a gate(s) between the energizer and other portions of the fence, electrical pulses shall be carried across the opening either by an overhead wire or underground by a buried insulated wire inserted through a protective sleeve of 1/2 inch diameter plastic pipe.

7. FENCING AT DEPRESSIONS

Where fencing is installed parallel to the ground surface, the line posts and/or battens subject to upward pull shall be anchored by means of extra embedment or by special anchors labeled for such applications, or as detailed on the drawings.

Where the fence is installed with the top wire straight and parallel to the ground surface on either side of the depression, extra length posts shall be used to allow normal post embedment. Unless otherwise specified, extra space between the bottom of the fence and ground shall be closed with extra strands of wire properly anchored.

8. CROSSING WATERCOURSES

Where the fence crosses small watercourses, end the main fence at the top of the streambank bank on each side with an appropriate end assembly. From separate posts driven next to end posts, construct a separate section of fence across the watercourse that shall be manually or automatically de-energized during high flow or flooding conditions. The only tie between the main fence and the section spanning the watercourse shall be a single electrical connection. In addition, an insulated overhead wire shall be erected to maintain electrical continuity with the fence on the other side of the watercourse.

Where the fence crosses larger watercourses or areas prone to frequent flooding capable of carrying debris which could significantly impair the functioning of the fence, special provisions, such as a breakaway fence or laying the wire on the ground will be made as shown on the drawings or specified in Section 13.

9. ELECTRICAL CONNECTIONS

All junctions of conductors normally intended to pass electric pulses shall have reliable, mechanically solid, and low resistance connections.

10. GROUNDING

Energizers shall be properly grounded and protected from lightning strikes coming through the fence and, where energizer is powered from a commercial/public electric utility, it shall also be protected according to the manufacturer's installation instructions.

Grounding electrodes shall be installed according to manufacturer's recommendations.

Under no circumstances shall more than one energizer charge the wires of the same fence.

The electrodes shall be free of any corrosion. Electrodes shall be a standard galvanized steel post, new 1/2 inch diameter galvanized steel pipe, or UL approved ground rod. The exterior surface of wires, clamps, and electrodes of grounding and earth return systems shall be of the same metal composition.

11. WARNING SIGNS

Conspicuous and clearly legible signs warning approaching people of the potential for electric shock at the fence shall be displayed. Signs shall be no farther apart than every 200 linear feet along reaches of fence adjacent to public transportation corridors, property boundaries, internal right-of-ways/easements, gates, and any other sites the public is likely to first encounter the fence.

12. MEASUREMENT AND PAYMENT

Method 1

For items of work for which specific unit prices are established in the contract, the length of each kind of fence will be measured to the nearest whole linear foot along the fence profile, including gate openings, stream crossings and other special structures. Payment will be made at the contract unit price for that kind of fence. Such payment shall constitute full compensation for all labor, materials, equipment, and all other appurtenances necessary and incidental to the performance of the work, including fabrication and installing of gates, installing energizers and required protective devices, signs and other special structures.

Method 2

For items of work for which specific lump sum prices are established in the contract, the length of each kind of fence will not be measured. Payment will be made at the contract lump sum price for that kind of fence. Such payment shall constitute full compensation for all labor, materials, equipment, and all other appurtenances necessary and incidental to the performance of the work, including fabrication and installing of gates, installing energizers and required protective devices, signs and other special structures.

Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 13.

13. ITEMS OF WORK AND ADDITIONAL CONDITIONS: